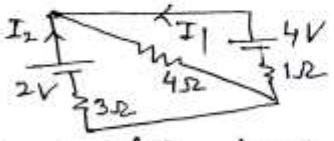
PAPER

Q(1). Define electric potential. Deduce an expression for eletric potential due to a point charge — $V = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$, symbols have usual meaning.

Q(2). State Gauss theorem. Using this theorem deduce coulomb's law.

Q(3). Using kirchhoff's laws, find I_1 and I_2 in the following network.



Q(4). Using potentiometer, explain how do we find internal resistance of a cell. Draw appropriate circuit diagram.

Q(5). For a parallel plate capacitor, deduce $C = \frac{\varepsilon_0 KA}{d}$, where symbols have usual meaning.

Q(6). State BIOT-SAVART Law. Using this law find magnetic field at the centre of circular current carrying coil $- B = \frac{\mu_0 i}{2r}$. Symbols have usual meaning.

Q(7). State Ampere-Circuital law. Using law find out magnetic field due to a straight and long current carrying conductor $B = \frac{\mu_0 i}{2\pi r}$, where symbols have usual meaning.

Q(8). Write construction and working of a moving coil galvanometer (MCG).

Q(9). Two long straight current carrying conductor carrying current I_1 and I_2 are r, distance apart. Show that force per unit length acting over conductor is $\frac{\mu_0 I_1 I_2}{2\pi r}$. Using this expression define One Ampere of current.

Q(10). State Huygen's Wave theory. Using this theory prove Snell's law of Refraction.

Q(11). Explain Fraunhoffer's diffraction due to Single Slit. Show that angle of diffraction θ, for first minima is $\frac{\lambda}{e}$, λ is wavelength of wave and e is width of slit

Q(12). What is MOTIONAL EMF? Deduce $\mathcal{E} = Blv$, where symbols have usual meaning.

Q(13). Using phasor method, show that impedence (Z) of LCR series circuit is $Z = \left((X_L - X_C)^2 + R^2\right)^{1/2}$, where symbols have usual meaning.

Q(14). State BREWESTER's law. Show that reflected ray and refracted ray are perpendicular to each other at polarising angle.

Q(15). Deduce Prism formula $n = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$

Q(16) Write conditions necessary for Total Internal Reflection (T.I.R.). An electric bulb is illuminated at a distance h below the free surface of a lake. Refractive index of water in the lake is n, find surface area of lake through which light of the electric bulb emerges out.

Q(17). for a refracting surface [spherical convex or concave] deduce $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$, where symbols have usual meaning.

Q(18). State and prove Lens-Maker's formula. Find focal-length of a symmetrical biconvex lense of radii of curvature 20 cm, and refractive index (1.5) in air.

Q(19). Find equivalent focal length (F) of two lenses of focal length (f_1) and (f_2) kept in contact.

(20). What is chromatic Aberration. Show that longitudinal chromatic Aberration due to a lens is, $f_R - f_V = \omega f$, where symbols have their usual meaning.

Q(21). Define Magnification for a microscope. Show that magnification due to a simple microscope, when final image is seen at least distance of distinct vision is $\left(1 + \frac{D}{f}\right)$, where symbols have usual meaning. Draw a neat ray diagram for formation of image.

Q(22). Draw ray diagram for formation of image due to a compound microscope when
(i) it is in normal adjustment
(ii) final image is seen with relaxed eye.
Write expression for M, magnification for both cases.

Q(23). Draw ray diagram for formation of image due to an Astronomical Refracting telescope when final image is seen at least distance of distinct vision and also at infinity (∞) [Normal Use]. Write expression for M, magnification for both cases.

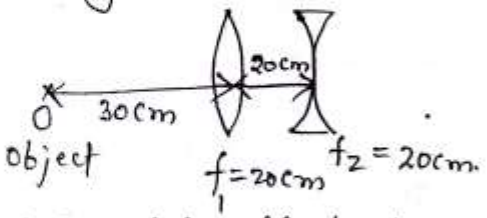
Q(24). Draw Ray diagram for formation of image due to a Reflecting Telescope. Write expression for its M, magnification.

Q(25). An Astronomical telescope in normal use has its length as 105 cm and Magnification, 20. Find focal length of its Objective and Eye piece.

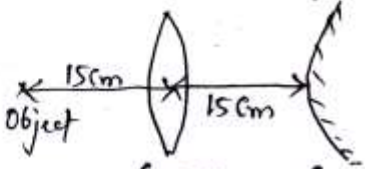
Q.(26) A compound microscope consist of lenses of focal length 2cm and 10cm. An object is placed at a distance of 2.10 cm from Objective and final image is seen at ∞, infinite. Find L, length of microscope and its magnification, M.

(27). Define Resolving Power of a magnifying device. Write two factors, to enhance Resolving power of a telescope. What is resolving limit?

(28)(a) Find the position of final image in the following diagram [arrangement]



(b) find focal length of mirror if image of object O is formed over itself.



(29). Answer the following question briefly.

(i) Sound waves cannot be polarised. Why?

(ii) Why can we hear the sound of distant moving a train during night, but do not receive any light from it?

(iii) Write the principle of working of an optical fibre.

(iv) What is effect over interference pattern due to YDSE, if whole setup is immersed in water?

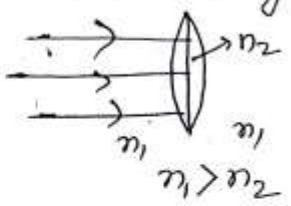
(v) What is phase difference between electric field and magnetic field vectors in an electromagnetic wave?

(vi) Name electromagnetic waves used in

(a) Radar Communication (b) Study of structure of crystal (c) Photosynthesis

(vii) A glass slab (RI) of thickness 4cm is placed over a book. What is shift in the position of letters as seen from its top?

(viii) Complete the following ray diagram



(ix) A symmetrical biconvex lens of focal length 10cm is cut into two equal halves such that each half is a planoconvex lens. What is focal length of planoconvex lens so obtained?

(x) How is scattering of wave related with its wavelength?

Q(30). Answer the following questions —

(i) Define time constant of L-R and C-R circuit.

(ii) State LENZ Law.

(iii) A 200 volt d/c voltage produces same heat across a resistance in given time as $V = V_0 \sin(314t)$ an a/c voltage does. What is RMS value of a/c voltage?

(iv) What is Wattless Current?

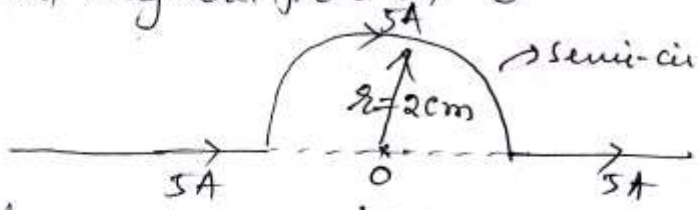
(v) What is power factor in purely resistive circuit?

(vi) At Resonance in LCR Series circuit, what is phase difference between overall voltage and current in the circuit?

(vii) Plot graphically variation of
(a) Capacitive reactance with frequency,
(b) Inductive reactance with frequency,
(c) Impedance of LR ckt with frequency,
(d) Impedence of CR ckt with frequency and Impedance
(e) of L CR Series circuit with frequency, of a/c source.

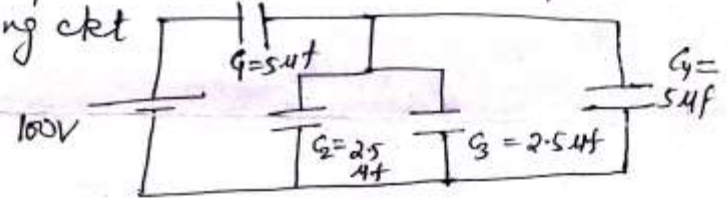
(viii) Write principle of working of a moving coil galvanometer.

A (ix) find magneter field at 'O'

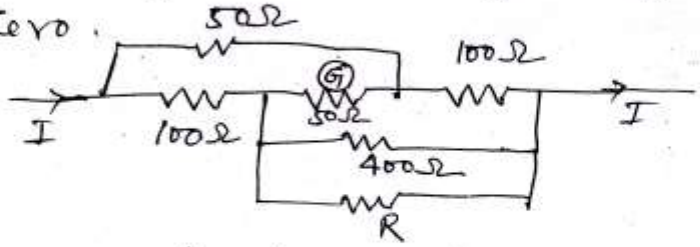


(x) A conducting wire of finite resistance is bent in the form of a circle and a battery is connected across any two points over its circumference. find magnetic field at its Centre, O.

Q(31) Find charge and potential over various capacitors in the following ckt



Q(32) Deduce balancing condition in a wheat stone bridge. Find R if current through (G), galvanometer is zero.



Q(33) A (G), galvanometer of 100Ω can measure current of 5mA. How can it be converted into (i) 50A, Ammeter
(ii) 100V, Voltmeter, Show the conversions through a diagram.

(34) (a) Current passing through primary coil is 2A. This current is reversed in 2 m.s. If Mutual inductance of coil is 5 H, what is the value of induced emf. in secondary coil?

(b) At any instant magnetic through a coil is 50 Wb, if inductance of coil is 2 m H, what is current through the coil.

(35) A train is moving horizontally due north with velocity of 90 Km p h. What is the value of emf. induced in its axle of length 1.2 m? Given, Earth magnetic field of the place is 15 mT and angle of dip is 30°.

(36) (a) Differentiate between Diamagnetic, Paramagnetic and ferromagnetic substances on the basis of temperature dependence of their magnetic susceptibility.

(b) How do we distinguish between unpolarised light, completely plane polarised light and partially plane polarised light ~~on~~ using a polaroid?

(37) Answer briefly —

(a) Write two uses of polaroids.

(b) Why do sunglass have zero power?

(c) Write use of cyclotron. Why is it not used to energise an electron?

(d) What is magnetic Hysteresis?

(e) What are various types of energy losses in a transformer? Explain any two.

(f) Why is steel preferred over soft iron for

making up a permanent magnet ?

(g) Write vector form of Biot-Savart Law.

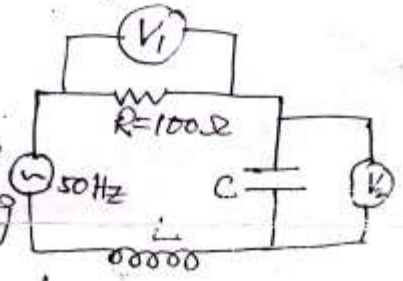
(h) What is net charge over a charged capacitor and over an electric dipole ?

(i) $\vec{E} \propto \vec{J}$; this is Ohm's law in vector form. What is constant of proportionality ?

(j) Uniform electric potential of 10^5 volt exist in certain part of space of volume $10^2\ m^3$. What is electric field Intensity there ?

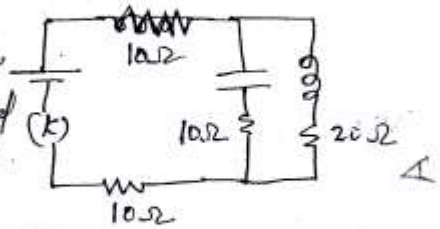
(38). Deduce an expression of electric field Intensity due to a short electric dipole at any point over its (i) END-ON Position
(ii) BROAD-ON Position.

(39) The adjacent figure shows a series LCR circuit connected to an ac source of 50 Hz. The reading of the voltmeter V_1 and V_2 are 80 V and 60 V respectively. Find



(i) Current in the circuit
(ii) The Capacitance C of the capacitor.
(iii) At resonance, what is the relation between impedance of a series LCR circuit and its resistance R ?

(40) (a) Find Current drawn from 60V the cell, when K is (i) just pressed (ii) After lapse of time.



(b) If the galvanometer in the adjacent ckt reads zero find the value of R. The 12V source has negligible resistance.